

CLAIMS

1. An optical head device comprising:
  - a light source;
  - 5 a diffractive optical element for diffracting light emitted from said light source to split the light into a main beam and sub-beams, said diffractive optical element is divided into first, second, third, and fourth regions by a first straight line that crosses an optical axis of the light and extends in an
  - 10 extending direction of a grating of said diffractive optical element and a second straight line that crosses the optical axis and is perpendicular to said first line;
  - an objective lens for focusing said main beam and said sub-beams onto an optical recording medium;
  - 15 an astigmatism generation unit for providing astigmatism to light reflected from said optical recording medium; and
  - a photodetector for receiving light transmitted through said astigmatism generation unit to receive the main beam and the sub-beams, wherein a phase of the grating in said first region
  - 20 and said second region located diagonally with respect to said first region is different from a phase of the grating in said third region and said fourth region that are adjacent to said first and second regions and are located diagonally by substantially  $\pi$ , and the main beam and the sub-beams are focused
  - 25 in a region containing the same track on said optical recording medium.
2. The optical head device according to claim 1, wherein said optical recording medium is circular in shape, said first

straight line is parallel to a tangential direction of a track in a region of said optical recording medium that is irradiated with light, and said second straight line is parallel to a radial direction in the region of said optical recording medium.

5     3.     The optical head device according to claim 1 or 2, wherein said main beam is zero-th order light transmitted through said diffractive optical element, and said sub-beams are minus first order diffracted light and plus first order diffracted light that have been diffracted by said diffractive optical element.

10    4.     The optical head device according to any one of claims 1 to 3, wherein said light source is a semiconductor laser.

5.     The optical head device according to any one of claims 1 to 4, comprising a beam splitter for allowing at least a part of light incident thereon from said diffractive optical element to  
15   exit toward said objective lens and for allowing at least a part of light incident thereon from said objective lens after being reflected from said optical recording medium to exit toward said astigmatism generation unit.

6.     The optical head device according to claim 5, wherein said  
20   beam splitter is a polarization beam splitter that transmits P-polarized light and reflects S-polarized light, and the optical head device further comprises a quarter-wave plate provided between said polarization beam splitter and said objective lens.

7.     An optical information recording or reproducing apparatus  
25   comprising:

        said optical head device according to any one of claims 1 to 6;

        an error signal generation circuit for generating focusing

error signals of said main beam and said sub-beams by an  
astigmatism method based on a detection signal of said  
photodetector and outputting a sum of the focusing error signals  
of said main beam and said sub-beams as a focusing error signal  
5 for a focusing-servo operation; and

an objective lens driving unit for controlling a position  
of said objective lens based on said focusing error signal for  
the focusing-servo operation.

8. The optical information recording or reproducing apparatus  
10 according to claim 7, wherein said error signal generation  
circuit generates tracking error signals of said main beam and  
said sub-beams by a push-pull method based on the detection  
signal of said photodetector and further outputs a difference  
between the tracking error signal of the main beam and the  
15 tracking error signal of the sub-beams as a tracking error signal  
for a tracking-servo operation, and said objective lens driving  
unit further controls the position of said objective lens based  
on said tracking error signal for the tracking-servo operation.

9. The optical information recording or reproducing apparatus  
20 according to claim 7 or 8, further comprising light source  
driving unit for controlling an output of said light source.

10. The optical information recording or reproducing apparatus  
according to claim 9, wherein said light source driving unit  
drives said light source based on recording data externally input  
25 thereto.

11. The optical information recording or reproducing apparatus  
according to claim 9, wherein said light source driving unit  
drives said light source with a constant output.